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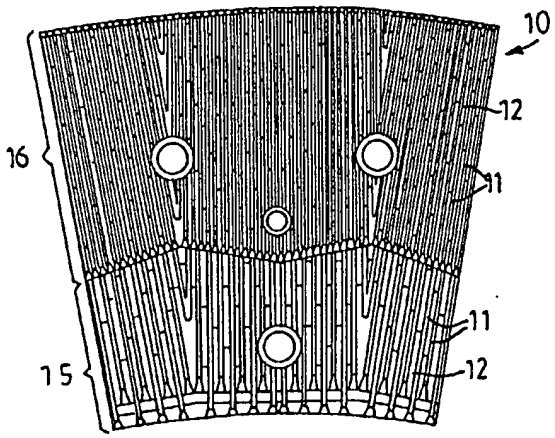


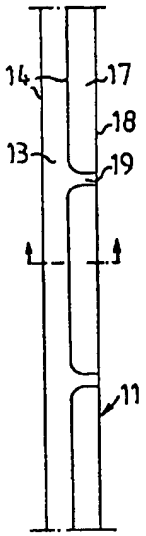


(57) Abstract

Refining element for refiners of disc-type for working fibrous material, where the refining element (10) is formed with a pattern of bars (11) with upper surfaces (13) and edges (14) and intermediate grooves (12). In the upper surfaces (13) of the bars (11) at least one step (17, 20, 21, 22, 23) is formed, so that at least two longitudinal edges (14, 18, 24) located at different heights are formed on the bars.

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# Refining element

This invention relates to refiners of disc-type with opposed refining discs rotating relative to each other. The refining discs are provided with refining elements, which between themselves form a refiner gap with a refiner zone for the working of fibrous material. The fibrous material preferably is lignocellulosic fiber material, and the refiner is used for manufacturing, for example, reject pulp, recycled fiber pulp and mechanical pulps such as board pulp, thermomechanical pulp (TMP) and chemi-thermomechanical pulp (CTMP) as well as chemical pulps.

The invention, more precisely, relates to a refining element for use in a refiner of the aforesaid type.

A refining element is designed with a pattern of bars and intermediate grooves. The bars and grooves are formed in different ways, depending on the fibrous material to be worked and on the degree of working and thereby, in the case of lignocellulosic material, on the pulp quality desired. The bars, for example, can be continuous or discontinuous and arranged in different patterns.

The refiner gap is designed so that the fibrous material shall pass from the inside out, seen in radial direction. Farthest inward in the refiner gap the refining elements normally are designed to bring about a first disintegration of the material and to advance the material further outward in the refiner gap. A certain defibration, i.e. separation of the fibers of the lignocellulosic material, also takes place in the inner portion of the refiner gap where the distance between the refining surfaces is greatest. Thereafter the distance decreases outward for achieving the desired working of the fibrous material.

The working of the fibrous material is carried out substantially by the bars of the refining elements. Their design, thus, is of essential importance for the pulp quality. Other factors of influence on the pulp quality are, for example, the size of the refiner gap, the liquid contents in the fibrous material, the feed, temperature etc.

The bars have an upper surface with edges. At the working of the fibrous material the bars are worn, especially their edges, which thereby get round. In cases where one refiner disc is stationary, its bars most often get worn most, because the difference in speed between the fibrous material and stationary refiner disc is greater than the difference in speed between the fibrous material and rotating refiner discs.

The wear is caused above all by the fact that sand and other hard foreign particles follow along with the fibrous material into the refiner and, thus, into the refiner gap where they repeatedly come into contact with the bars of the refining elements.

The refiner discs normally have a rotation speed of up to 3000 revolutions per minute relative to each other, and the refiner gap normally has a size of about 0.2 to 2 mm. Foreign hard particles with a diameter greater than the refiner gap thereby can cause great damage on the refining elements, but also small particles subject the refining elements to wear.

When the leading bar edge due to wear is rounded off, the energy demand for manufacturing a desired pulp quality increases. The degree of working, and thereby the pulp quality, depend on the refiner gap, the size of which is controlled so that the desired pulp quality shall be obtained. With increased and uneven wear of the bar edges problems arise to maintain the desired pulp quality, which means that the refining elements must be exchanged.

The wear down of bars is an especially great problem at the manufacture of fiberboard pulp where the fibrous material often includes many impurities, for example stones and sand. The refining elements must be exchanged when they are worn, which implies a shutdown of the process. It is, therefore, desired to maintain the sharpness of the bar edges for as long as possible.

The present invention offers a solution of the aforesaid problems. According to the invention it is, thus, possible to use refining elements for a longer time without increased energy demand and with maintained pulp quality. By forming at least one step

in the upper surfaces of the bars, at least two longitudinal edges located at different heights on the bars are formed. This means that initially the uppermost edge is active and subjected to wear. As the uppermost edge gradually gets worn, the edge work is taken over by the bar edge located nearest downward on the step. Hereby the service life for the refining element can be extended substantially.

The steps can extend, for example, along the entire length of the bars or be broken by small portions without step in the longitudinal direction of the bars. Each step can have along the bars a constant or varying depth into the upper surfaces of the bars. The steps can be formed on only one or on both sides of the bars. Preferably a single step is provided on a bar, but in certain cases two or more steps can be formed.

When steps are formed only on one side of the bars, the rotation direction of the refining discs carrying the refining elements cannot be changed. With regard to strength, however, this may still be suitable design.

The characterizing features of the invention are apparent from the attached claims. The invention is described in greater detail in the following, with reference to the accompanying drawing illustrating some embodiments of the invention.

**Fig. 1** shows the front side of a refining element with a pattern of bars and intermediate grooves,
**Figs. 2-5** show the upper surface of the bars with different design,
**Fig. 6** is a cross-section of a bar according to Figs. 2-4,
**Fig. 7** is a cross-section of a bar according to Fig. 5.

In Fig.1 a refining element 10 is shown, which is provided with a pattern of bars 11 and intermediate grooves 12, where the bars have upper surfaces 13 with edges 14. The pattern is divided into two zones, an inner one 15 and an outer one 16. The bars and grooves in the inner zone are coarser than in the outer zone. The bars in the inner zone are intended to bring about a first disentegration of the material and to advance the material outward to the outer zone. The bars in the outer zone are arranged more

densely, which implies more bar edges for effecting the substantial defibration and working of the material. The pattern can also comprise more zones, in which case the pattern usually is made more dense from one zone to another, radially outward.

In Fig. 2 an embodiment of a bar 11 on a refining element according to the invention is shown. Along the bar 11 a step 17 extends which is located downwardly of the upper surface 13 of the bar. The difference in level shall be one or some mm, preferably 2-5 mm. Thereby, two longitudinal edges located on different heights are formed, viz. the edge 14 on the upper surface of the bar and the edge 18 on the step 17. The step 17 has a constant depth into the bar, but along the bar is broken by small portions 19 without step, in order to improve the strength of the bar 11. The transition from the step 17 to the level located above on the bar suitably is rounded, as appears from Fig. 6, in order to give optimum strength to the bar.

In Fig. 3 another embodiment of the bar is shown. It differs from Fig. 2 in that the step 20 has a varying depth along the bar into the upper surface 13 of the bar.

In Fig. 4 an embodiment with steps 21 on both sides of the bar 11 is shown. This implies that a refining element with such bars can rotate in both directions.

In Figs. 5 and 7 another alternative of a bar with two steps 22, 23 on different levels is shown, where on the bar an additional edge 24 on the lowest step 23 is formed. It is, of course, furthermore possible to combine the shown embodiment of bars in a suitable way on a refining element.

Bars designed according to the invention can be arranged in any zone on the refining element, but preferably in an outer zone where the defibration and working is most intensive, and the distance between opposed refining elements is shortest, i.e. the refiner gap is smallest.

The invention, of course, is not restricted to the embodiments shown, but can be varied within the scope of the claims with reference to the description and Figures.

# Claims

1. Refining element intended for refiners of disc-type for the working of fibrous material, where the refining element (10) is formed with a pattern of bars (11) with upper surfaces (13) and edges (14) and intermediate grooves (12), **characterized in** that in the upper surfaces (13) of the bars (11) at least one step (17, 20, 21, 22, 23) is formed, so that at least two longitudinal edges (14, 18, 24) located at different heights are formed on the bars.

2. Refining element as defined in claim 1, **characterized in** that every step (17) extends along the entire length of the bars (11).

3. Refining element as defined in claim 1, **characterized in** that every step (17, 20, 21, 22) is broken by portions without step in the longitudinal direction of the bars.

4. Refining element as defined in any one of the preceding claims, **characterized in** that every step (17, 22, 23) has a constant depth into the upper surfaces (13) of the bars (11).

5. Refining element as defined in any one of the claims 1-3, **characterized in** that every step has a varying depth along the bars into the upper surfaces of the bars.

6. Refining element as defined in any one of the preceding claims, **characterized in** that the steps are formed on only one side of the bars.

7. Refining element as defined in any one of the claims 1-5, **characterized in** that the steps are formed on both sides of the bars.

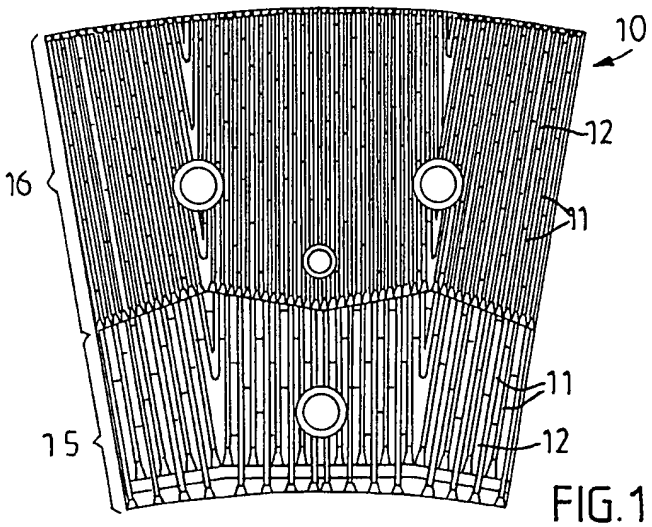


FIG.1

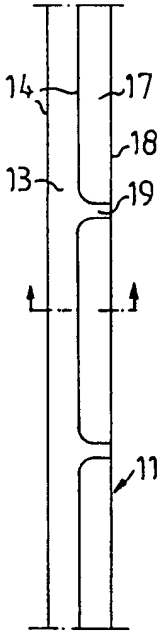


FIG.2

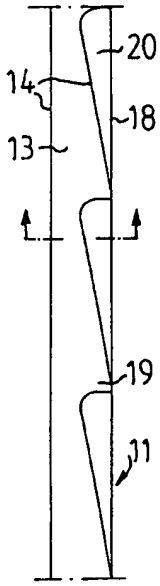


FIG.3

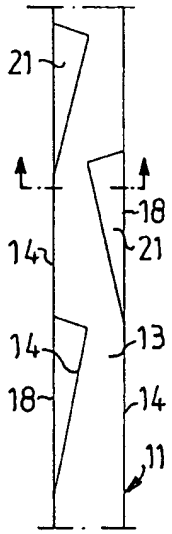


FIG.4

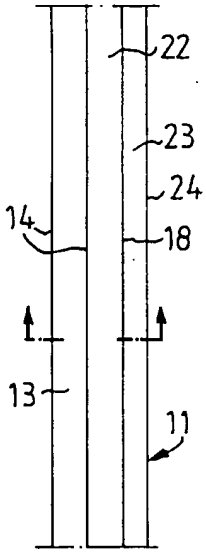


FIG.5

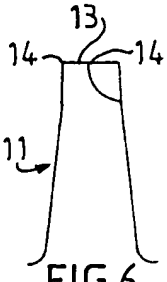


FIG.6

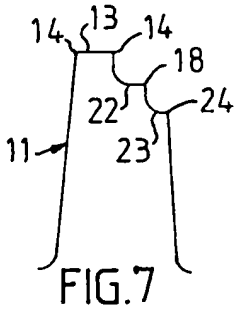


FIG.7

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/00420

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B02C 7/12, D21B 1/14, D21D 1/30
According to International Patent Classification (IPC) or to both national classification and IPC

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

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| X | US 5467931 A (JOHN DODD), 21 November 1995 (21.11.95), column 1, line 64 - column 2, line 2, figures 3-5,8b,c, claim 1<br><br>--<br>-------- | 1 |

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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Information on patent family members

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